BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC **SEMESTER : VII**
BRANCH: CHEMISTRY **SESSION : MO/19**

SUBJECT: SAC1001 ADVANCED PHYSICAL CHEMISTRY

TIME: 03 hrs **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Discuss the kinetics of parallel reactions with examples. [6]
Q.1(b) Discuss the general features of fast reactions. How will you determine the kinetics of fast reactions by stopped-flow method? [6]

Q.2(a) What is Langmuir adsorption theorem? Derive the Langmuir adsorption equation. [6]
Q.2(b) Discuss the theory BET adsorption isotherm along with its applications. [6]

Q.3(a) Give an account of the Debye-Huckel theory of strong electrolytes. Explain clearly what is meant by asymmetry and electrophoretic effect? [6]
Q.3(b) Write down the Debye-Huckel-Onsager equation. What is Debye-Fulkenhagen effect? [6]

Q.4(a) What do you mean by electrified interface? Discuss about the different model of electrical double layres. [6]
Q.4(b) Derive the polarographic equation for half-wave potential. What is its significance? [6]

Q.5(a) Derive the Stern-Volmer equation for bimolecular quenching process. [6]
Q.5(b) Derive the rate equation for photochemical reaction between H_2 and Br_2. [6]

Q.6(a) Compute ΔS for the process H_2O (l, -5 °C) = H_2O (s, -5 °C) Specific heat of water and ice over the temperature range is 1.0 and 0.5 cal deg^{-1} g^{-1} respectively and latent heat of fusion of ice 80 cal gm^{-1} [6]
Q.6(b) 0.1 mole of mono-atomic gas with Cv independent of temperature is made to undergo a reversible cyclic process consisting of the following steps [6]

State 1 (1 lit, 1 atm.) ⟶ State 2 (1 lit, 3 atm.)
State 2 ⟶ State 3 (2 lit, 3 atm.)
State 3 ⟶ State 4 (2 lit, 1 atm.)
State 4 ⟶ State 1

Calculate Q, W and ΔU, for each step and for the complete cycle.

Q.7(a) What is chemical potential? What is its physical significance? [6]
Two thermodynamic functions *Y* and *Z* are given as Y= f (T, P, n_i) and Z= f (T, P, X_i) where n_i and X_i represents mole number and mole fraction of '*i*'th species, respectively. Identify Y and Z as extensive or intensive.
Q.7(b) Calculate the expression for entropy change due to mixing of gases. [6]
Calculate the entropy of mixing of 2 moles of N_2 and 3 moles of H_2 behaving as ideal gases at constant T, P.

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